Supplementary material

Plastic waste management in India: Challenges, opportunities, and roadmap for circular economy

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Tables

Table S1. Summary of review articles published from India (2005-March 2021).

Topic	References
Biodegradable polymer/biopolymer application and sustainable design	[1-23]
Benchmarking of bioplastics	[24]
Separation of lactic acid (as a main constitutes of biopolymer)	[25]
Impact of COVID 19 on PW management	[26]
Application of PW composite in construction	[27-29]
Hybrid bio composite development	[30,31]
Effect of biotechnological and molecular technology (microbial routes) in plastic degradation	[32-51],
Properties of thermoplastics and rubber and their application as encapsulation (in product manufacturing)	[52,53]
Sustainable alternative sources for plastic production	[54]
Application of azo dye in plastics for enhanced biodegradability	[55,56]
Circular economy and plastic pollution from G20 policy perspectives	[57]
Plastic pollution in costal marine environment	[58]
Policy perspectives of marine plastics pollution in the Bay of Bengal areas	[59]
Microplastic pollution	[60-65]

Bioaugmentation of PWs in landfills and oceans	[66]
Development of index for handling and recycling of PW	[67]
Enzymatic remediation of Polyethylene Terephthalate (PET) PW	[68]
Challenges and solutions for single use plastics for food packaging	[69]
Manufacturing techniques and application of polymer matrix composites	[70]
Pyrolysis-oriented and catalyst applications in fuel production from PW	[71-76]
Waste plastic derived fuel in diesel engine	[77-81],
Edible film production	[82]
Biodiesel production from PW	[83]
application of PW in concrete production	[84-86]
Chitin for packaging materials	[87]
Pyrolysis and gasification of PW	[88]
Chemical processing of PVC	[89]
Recycling of polystyrene	[90]
Tertiary recycling of HDPE	[91]
Degradation of PE	[92]
Wood polymer composite processing, properties and applications	[93]
Health impact of bisphenol A and its biosensing	[94-97]
Human health impacts due to plastics, health management practices and EPR	[97,98]
Biodegradability of blended polymers	[99]
Separation and conversion of PW from municipal solid waste (MSW)	[100]
Processing techniques of polymer reinforced composites	[101]
Hydrogen and carbon nanotube production from PW	[102]
Hydrogen production from biopolymer	[103]
pyrolysis for energy recovery	[79]
Chemical recycling method for fiber reinforced plastics	[104]
Recycled polymer application in mineral and metallurgical processing	[105]
Recycling of polystyrene based plastics	[106]
Biomaterial application in engineering	[107]
Waste plastics application in automobile sector	[108]
Development circumstances of plastic recycling industry	[109]

Table S2. Plastic use in various components in automobile [110]

Component	Main types of plastics
Bumpers	PS, ABS, PC/PBT, PP
Seats	PUR, PP, PVC, ABS, PA
Dashboard	PP, ABS, SMA, PPE, PC
Fuel systems	HDPE, POM, PA, PP, PBT
Body (including panels)	PP, PPE, UP
Under bonnet components	PA, PP, PBT
Interior trim	PP, ABS, PET, POM, PVC
Electrical components	PP, PE, PBT, PA, PVC
Exterior trim	ABS, PA, PBT, POM, ASA, PP
Lighting	PC, PBT, ABS, PMMA, UP
Upholstery	PVC, PUR, PP, PE
Liquid reservoir	PP, PE, PA

Table S3. Indian states contributing towards addition of PW into Ganges River [59]

Indian States	Consumption/year	PW Management	Ban/Partially Ban
Uttarakhand	3016.3ton/annum 2015/16	Information on PW management and compliance is not available.	A complete ban on the use of plastic carrier bags.
Uttar Pradesh	152492.65 tons/annum 2016/17	NA	A complete ban on the manufacture, import, storage, transportation, sale, and use of plastic carry bags in this State. A complete ban on plastic carry bags
Bihar	2280 tons/annum 2016/17	Information on PW management not available	Partial Ban
Jharkhand	35,853 tones/annum, 2015-16	Information on PW management not available	Partial Ban

Table S4 The types of plastics generated and produced in India

Application of plastics	Type of plastics
Packaging -Flexible, Rigid and Others	PP, PE, PVC, PS, PL, PA, PET, Nylon

Infrastructure	HDPE, LDPE, PP, PS, PET, PC
Automotive	PC, PP, PVC, PS, PE, PET
Biomedical	PVC, PP, PE, PS, PET
Electrical and Electronics	ABS, PVC, LDPE, HDPE, PE, PP, PS,

Figures

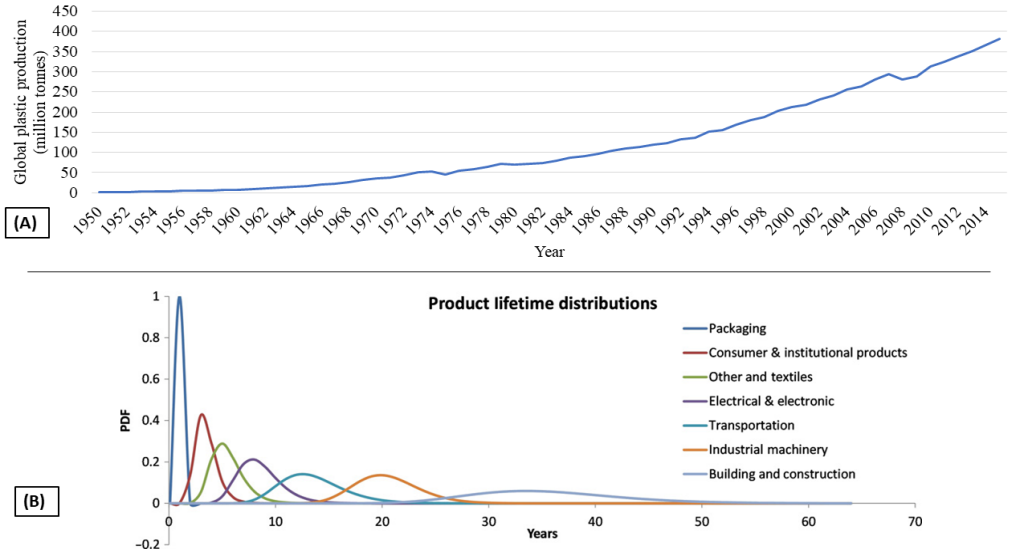

Figure S1 (A) Global plastic production from 1950-2014 [111] and (B) plastic-related product lifespan distribution in various sectors, adapted from Geyer, *et al.* [112].

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